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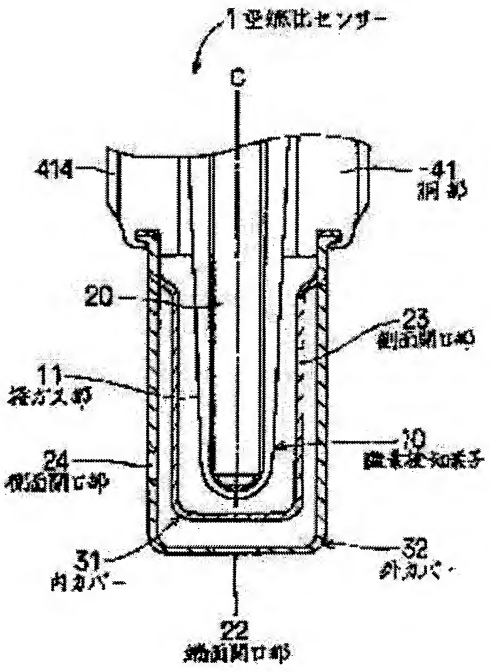
(54) AIR-FUEL RATIO SENSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an air-fuel ratio sensor which can effectively restrain condensed water from creeping.

SOLUTION: An air-fuel ratio sensor for an internal-combustion engine is provided with an oxygen detection element 10 comprising a gas contact part 11, with a trunk part 41 holding the oxygen detection element 10 and with element covers 31, 32 which comprise opening parts used to introduce an exhaust gas. The element covers 31, 32 are formed as an internal cover situated on the innermost side and as a single or a plurality of external covers. Edge opening parts are formed in the tip face of the internal cover and in tip faces of the respective outer covers. The edge opening parts 22 in the adjacent covers are arranged so as to be dislocated from each other in such a way that the flow passage of the exhaust gas reaching the gas contact part 11 becomes long. It is preferable that a side-face opening part 23 in the internal cover is formed in a part at a distance from the high-temperature part of the gas contact part.



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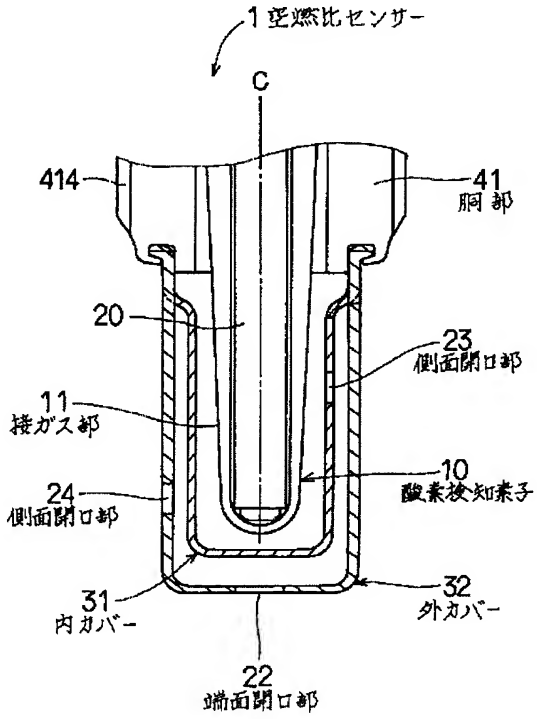
(54)【発明の名称】　空燃比センサー

(57)【要約】
【課題】　凝縮水の進入を効果的に抑制することの出来る空燃比センサーの提供。
【解決手段】　接ガス部１１を備えた酸素検知素子１０と，酸素検知素子１０を保持する胴部４１と，排気ガスを導入する開口部を備えた素子カバー３１，３２とを有する内燃機関の空燃比センサー１である。素子カバー31，３２は，最も内側に位置する内カバー３１と単一又は複数の外カバー３２とを有し，内カバー３１の先端面と各外カバー３２の先端面には端面開口部２１，２２が設けられ，接ガス部１１に達する排気ガスの流路を長くするように隣接するカバーの端面開口部２２，２１は互いに位置をずらして配置されている。内カバー３１の側面開口部２３は接ガス部の高温部から離れた部位に設けることが好ましい。



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【特許請求の範囲】

【請求項１】　固体電解質からなる被測定ガスとの接ガス部を備えた酸素検知素子と，この酸素検知素子を保持する胴部と，上記接ガス部の先端側を覆い排気ガスを導入する開口部を備えた素子カバーとを有する空燃比センサーであって，上記素子カバーは，上記接ガス部に近い内側に位置する内カバーとこの内カバーの外側に位置する単一又は複数の外カバーとを有すると共に上記内カバーの先端面と各外カバーの先端面には排気ガスを導入する端面開口部が設けられると共に，各端面開口部は上記接ガス部に達する排気ガスの流路を長くするように隣接するカバーの端面開口部に対する位置をずらして配置されていることを特徴とする空燃比センサー。

【請求項２】　請求項１において，更に前記内カバーの側面と前期各外カバーの側面にも側面開口部が設けられており，上記側面開口部は前記接ガス部に達する排気ガスの流路を長くするように隣接するカバーの側面開口部に対する位置をずらして配置されていることを特徴とする空燃比センサー。

【請求項３】　請求項２において，最も外側に位置する表面外カバーの側面開口部は，排気管に装着した場合において排気ガスの流速が相対的に大きくなる先端寄りの位置に設けられていることを特徴とする空燃比センサー。

【請求項４】　請求項２または請求項３において，前記酸素検知素子には反応を促進するための加熱手段が備えられており，前記内カバーの側面開口部は前記接ガス部の高温部から離隔した位置に設けられていることを特徴とする空燃比センサー。

【請求項５】　請求項１から請求項４のいずれか１項において，前記内カバーの端面開口部は，前記接ガス部の基端部側から先端部側に向かう軸心線から離隔して配置されており，上記内カバーに隣接する外カバーの端面開口部は，上記軸心線上または軸心線の近傍に配置されていることを特徴とする空燃比センサー。

【発明の詳細な説明】

【０００１】

【技術分野】本発明は，自動車内燃機関等の排気ガスの空燃比状態を検出する空燃比センサーの構造に関するものであり，特に排気管中に存在する凝縮水の進入による不具合を抑制することの出来るセンサー構造に関する。

【０００２】

【従来技術】内燃機関の空燃比の調節は，省エネルギー（省燃料）及び排ガス浄化のために極めて重要である。そして，空燃比を検出するセンサとして，酸素イオン導電性を有する固体電解質に一対以上の電極とガス拡散抵抗層を付加した電気化学的セルが多く用いられている。そして，排気ガスの温度が低いアイドリング時や始動時においても，安定した出力が得られるように，通常上記酸素検知素子の内側には電極部に対向してヒータユニットが配置されている。

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【０００３】即ち，例えば図１７に示すように，上記空燃比センサー９０は，電気化学的セルを形成する有底筒状の酸素検知素子９１と，酸素検知素子９１を収容する容器９２とを有している。容器９２は，酸素検知素子９１を保持する胴部９３を有しており，胴部９３の略中央部には，センサ本体を排気通路に装着するためのフランジ９３１が形成されている。そして，フランジ９３１から先の部分は先端側を下方に向けて排気通路に挿入されて装着される。また，酸素検知素子９１は，タルク９３２を介設させて，胴部９３に固定されている。

【０００４】更に，酸素検知素子９１の内側には，通常ヒータユニット９６が挿入されており，ヒータユニット９６はホルダ９６１を介して酸素検知素子９１に支持されている。そして，酸素検知素子９１は有底筒状の固体電解質と，出力取り出し用の電極とを有している。そして，酸素検知素子９１の電極は，出力取出線９７と接続されており，ヒータユニット９６は，給電線９７２に接続されている。

【０００５】一方，胴部９３の下方（先端側）には排気通路に挿入される内側と外側の一対の素子カバー９４１，９４２を有し，胴部９３の上方の基端部側には大気と接するカバー部材９５１～９５３を有している。そして，それぞれの素子カバー９４１，９４２の側面には排気を導入する開口部９４３，９４４が設けられ，カバー部材９５２，９５３には大気を導入する大気口９５４，９５５が設けられている。また，カバー部材９５２，９５３の間の前記大気口９５４，９５５により大気導入通路となる途上には，はっ水性通気フィルター９５６が設けられている。

【０００６】上記素子カバー９４１，９４２の側面開口部９４３，９４４は，酸素検知素子９１の周囲（接ガス部）に被測定ガスである排気ガスを迅速に導入し，センサーの応答速度を速めるように形成されなければならない。しかしながら，一方では排気ガス中の異物や排気通路に存在する凝縮水等（以下，単に凝縮水という）が，酸素検知素子９１に付着するのを抑制する必要がある。

【０００７】即ち，図１６に示すように，空燃比センサー９０は，先端側を下にして排気管８５の様々の位置に取り付けられる。そして，酸素検知素子９１が高温の排気ガスに曝されないようにするためや触媒浄化装置の下流側排気ガス中の酸素濃度を検知する等の目的のために，空燃比センサー９０は内燃機関の出口のエキゾーストマニホールドではなく下流側の排気管８５に配置されるようになって来ている。そして，下流側の排気管８５の内側の主に底面には凝縮水８６が滞留する場合が生じ，そのため，これがエンジンの始動時などに排気ガスの流れと共に飛散し，前記開口部９４３，９４４から空燃比センサー９０の内部に進入する。

【０００８】そして，上記凝縮水８６が酸素検知素子９

１に付着すると，検出特性を変化させるばかりでなく，高温の素子に低温の凝縮水が付着した場合に生ずる熱応力のため素子が割れるという不具合を生ずることがある。そのため，上記開口部９４３，９４４は，排気の流通路を長くして凝縮水が酸素検知素子に達しないようにする為に，曲がりくねった迷路状となるように互い違いに配置される。また，素子カバー９４１，９４２を複数設けて多重にするのもその為である。

【０００９】また，図１８に示すように，素子カバー内部に進入した凝縮水等の異物を外部に自然滴下させるために素子カバー９４６，９４７の先端にも開口部９４８，９４９を設けるという構造が提案されいてる（特開平５－２６８４２号公報等）。また，素子カバー９４６，９４７の先端に開口部９４８，９４９を設ければ開口部が増えることより排気ガスの進入を容易にし，センサーの応答を良好にするという利点もある。

【００１０】

【解決しようとする課題】しかしながら，上記のような防止対策を講じているにもかかわらず，酸素検知素子に対する凝縮水付着の抑制は未だ不十分であり，時に素子が割れるという不具合が生じている。本発明は，かかる従来の問題点に鑑みてなされたものてあり，センサーの応答特性を良好に保持しつつ凝縮水の内部進入及び素子割れを効果的に抑制することの出来る空燃比センサーを提供しようとするものである。

【００１１】

【課題の解決手段】本願の請求項１の発明は，内カバーの先端面と各外カバーの先端面に排気ガスを導入する端面開口部を設け，各端面開口部は接ガス部に達する排気ガスの流路を長くするように隣接するカバーの端面開口部に対する位置をずらして配置することを特徴とする。その結果，本発明の空燃比センサーは凝縮水の進入を効果的に抑制することができる。

【００１２】即ち，図１６に示すように，排気管８５に付着する凝縮水８６は排気管８５の底部に特に多く存在し，これがエンジンの始動に伴い上方に吹き上げられる。そのため，多くの凝縮水８６は素子カバーの先端面から上方に向かって進入することとなる。それ故，図１８に示す従来装置の先端開口部９４８，９４９のように，互いに重なり合うように同じ位置に開口部が配置されている場合には，凝縮水８６が開口部９４８，９４９からストレートに酸素検知素子９１に向かって進み，酸素検知素子９１の先端部に付着し易くなる。

【００１３】しかしながら，本発明では，端面開口部は接ガス部に達する排気ガスの流路を長くするよう互いに位置をずらして配置されているから，長い流路の途中で素子カバーに付着し，酸素検知素子の接ガス部に達しにくくなる。

【００１４】また，請求項２の発明では，更に，側面開口部が設けられており，側面開口部は接ガス部に達する排気ガスの流路を長くするように配置されている。そのため，側面開口部から進入する凝縮水も接ガス部に達し難くなる。また，側面開口部は，排気ガスの流れに対向するから，排気ガスを迅速に取り入れることができ，センサーの応答を良好にすることが出来る。

【００１５】また，請求項３記載のように，最も外側に位置する表面外カバーの側面開口部は，排気管に装着した場合において排気ガスの流速が相対的に大きくなる先端寄りに設けることが好ましい。排気管内の排気ガスの流速の分布は，管壁から管路の中心部に向かうにつれて大きくなるから，上記側面開口部は排気管路の中心部ないしその近傍に位置することが排気ガスを取り入れる効果が大きい。そして，管路に装着した場合に排気管路の中心部ないし近傍に位置するのは，素子カバーの先端寄りの部分となるから，効率的に排気ガスを取り入れることができる。

【００１６】そして，酸素検知素子に反応を促進するための加熱手段（ヒーター等）が備えられている場合等においては，請求項４記載のように，前記内カバーの側面開口部は接ガス部の高温部から離隔した位置に設けることが好ましい。前記のように，凝縮水が酸素検知素子に付着して生ずる素子割れは，高温の素子に低温の凝縮水が付着することによる熱応力による。従って，内部に進入した凝縮水が素子へ付着する場所は，出来るだけ素子の低温部となる構造にすることが望ましいからである。

【００１７】また，請求項５記載のように，内カバーの先端面の開口部を接ガス部の基端部側から先端部側に向かう軸心線Ｃから距離を置いて形成し，上記内カバーに隣接する外カバーの先端面の開口部は，上記軸心線上または軸心線の近傍に形成することが好ましい。従来装置のように内カバーの端面開口部を酸素検知素子９０の軸心線Ｃ上（図１８）または軸心線の近傍に配置すると，素子部に進入した凝縮水は素子に近接する内カバーの端面開口部から素子の先端の中心部（軸心線近傍）に集中して付着し易くなる。

【００１８】そして，凝縮水が集中することから，凝縮水付着に伴う熱応力が大きくなり，素子割れをおこし易くなる。しかしながら，請求項５記載の発明では上記のように，内カバーの先端面の開口部を軸心線の周りに距離を置いて広く配置することにより，凝縮水が素子の先端中心部に集中せず分散することから，凝縮水の付着に伴う熱応力が小さくなり，素子割れを起こし難くなる。

【００１９】

【発明の実施の形態】

実施形態例１

本例は，図１，図２に示すように，固体電解質からなる接ガス部１１を備えた酸素検知素子１０と，この酸素検知素子を保持する胴部４１と，接ガス部１１の先端側を覆い排気ガスを導入する開口部２１～２４を備えた素子カバー３１，３２とを有する内燃機関の空燃比センサー

１である。

【００２０】素子カバー３１，３２は，図３，図４に示すように，接ガス部１１に近い内側に位置する内カバー３１とこの内カバー３１の外側に位置する外カバー３２とを有する。そして，内カバー３１の先端面と外カバー３２の先端面には排気ガスを導入する端面開口部２１，２２が設けられ，各端面開口部２１，２２は接ガス部１１に達する排気ガスの流路を長くするように隣接するカバーの端面開口部２２，２１は互いに位置をずらして配置されている。

【００２１】また，内カバー３１の端面開口部２１は，接ガス部１１の基端部側から先端部側に向かう軸心線Ｃ（図１）の周りに距離を置いて略対称形に３個配置されており，内カバー３１に隣接する外カバー３２の端面開口部２２は，上記軸心線Ｃ上に１個だけ形成されている。また，内カバー３１の側面と外カバー３２の側面には側面開口部２３，２４がそれぞれ６個ずつ設けられており，側面開口部２３，２４は接ガス部１１に達する排気ガスの流路を長くするように隣接するカバーの側面開口部２４，２３は互いに位置をずらして向き合わないように配置されている。

【００２２】そして，外カバー３２の側面開口部２４は，図１６に示したように，排気管８５に装着した場合において排気ガスの流速が相対的に大きくなる先端寄りに設けられている。また，図１，図２に示すように，酸素検知素子１０には反応を促進するための加熱手段（ヒーターユニツト２０）が備えられており，内カバー３１の側面開口部２３は接ガス部１１の高温部から離れた基端部寄り（相対的に温度の低い部位）に設けられている。

【００２３】以下，それぞれについて説明を補足する。本例は，自動車のエンジンの空燃比を検知する空燃比センサー１である。図２に示すように，胴部４１は，排気通路に設けたネジ穴に螺合するネジ部４１４と，排気通路に当接するフランジ部４１５とを有している。　また，基端部側に位置するカバー部材４４２，４４３には，酸素検知素子１０に大気を導入する大気取入口４４４，４４５が設けられている。また，前記大気取入口４４４，と４４５により大気導入通路となる途上には，はっ水性の通気フィルター４４６が設けられている。

【００２４】酸素検知素子１０は，タルク４１６を介設させて胴部４１に保持されている。図２において，符号４６２はガスケット，符号４６３は金属性リング，符号１６１は出力取出線である。また，酸素検知素子１０の内側にはヒータユニット２０が挿入されており，ヒータユニット２０は，ホルダ４７を介して酸素検知素子１０に支持されている。そして，ヒータユニット２０には，図示しない発熱電線が付設してあり，該発熱電線は，給電線１６２に接続されている。

【００２５】出力取出線１６１及び給電線１６２は，ブッシュを介してカバー部材４４２，４４３により固定されている。また，大気取入口４４４，４４５から取入れた大気を酸素検知素子１０の内側に導く図示しない大気通路が設けられている。

【００２６】次に本例の空燃比センサー１の作用効果について述べる。本例の空燃比センサー１は，図３，図４に示すように，内カバー３１の先端面と外カバー３２の先端面に排気ガスを導入する端面開口部２１，２２を設け，各端面開口部２１，２２は接ガス部１１に達する排気ガスの流路を長くするように隣接するカバー３２，３１の端面開口部２２，２１は互いに位置をずらして配置されている。そのため，酸素検知素子１０への凝縮水の進入を効果的に抑制することができる。

【００２７】即ち，図１６に示すように，排気管８５に付着する凝縮水８６は排気管の底部に特に多く溜まり，これがエンジンの始動に伴い排気ガスにより上方に吹き上げられる。そのため，多くの凝縮水８６は素子カバー３１，３２の先端面から上方に向かって進入することとなる。しかしながら，本例では，端面開口部２１，２２は接ガス部１１に達する排気ガスの流路を長くするように位置をずらして配置されているから，凝縮水８６は外カバーの端面開口部２２から接ガス部１１に至る流路の途中で進入を妨げられ，接ガス部１１迄達しにくい。

【００２８】また，素子カバー３１，３２の側面に側面開口部２３，２４が設けられており，上記側面開口部２３，２４も接ガス部１１に達する排気ガスの流路を長くするように配置されているから，側面開口部２３，２４から進入する凝縮水８６も接ガス部１１に達し難くなる。そして，側面開口部２３，２４は，排気ガスの流れに対向するから，排気ガスを迅速に取り入れることができ，センサーの応答を良好にすることが出来る。

【００２９】また，外カバー３２の側面開口部２４は，排気管８５に装着した場合において排気ガスの流速が相対的に大きくなる先端寄りに設けられているから，排気ガスを取り入れ易い。即ち，排気管８５内の排気ガスの流速の分布は，管壁から管路の中心部に向かうにつれて大きくなるから，排気管８５の中心部ないしその近傍に位置する側面開口部２４は，排気ガスを取り入れ易い。

【００３０】内カバー３１の側面開口部２３は，接ガス部１１の高温部（先端寄り）から離隔した基端部寄りに設けられている。前記のように，凝縮水が酸素検知素子１０に付着して生ずる素子割れは，高温の素子に低温の凝縮水が付着した熱応力によるから，進入した凝縮水の素子への付着が避けられない場合には，出来るだけ素子の低温部に付着する構造にすることが望ましい。従って，凝縮水が接ガス部１１の比較的低温の部位に付着する本装置では，凝縮水の付着による熱応力が小さくなり，素子割れが生じにくくなる。

【００３１】また，図３に示すように，内カバー３１の先端面の開口部２１を接ガス部１１の基端部側から先端

部側に向かう軸心線Ｃ（図１）の周りに距離を置いて略対称形に配置し，内カバー３１に隣接する外カバー３２の先端面の開口部２２は，図４に示すように，上記軸心線Ｃ上に形成されている。

【００３２】図１８に示す従来装置のように内カバー９４６の端面開口部９４８，外カバー９４７の端面開口部９４９を軸心線Ｃ上に配置すると，素子部に進入する凝縮水８６は上記内カバー９４６及び外カバー９４７の端面開口部９４８，９４９から酸素検知素子９１の先端の中心部（軸心線Ｃ近傍）に集中的に付着し易くなる。そして，凝縮水が集中することから，凝縮水付着に伴う熱応力が大きくなり，素子割れをおこし易くなる。しかしながら，本例のように，内カバー３１の先端面の開口部２１を軸心線Ｃの周りに距離を置いて広く分布させることにより，凝縮水が素子の先端中心部に集中せず分散することから，また内カバー３１と外カバー３２の端面開口部２１，２２は互いに位置をずらしていることにより，凝縮水の付着に伴う熱応力が小さくなり，素子割れがおこり難くなる。

【００３３】その結果，図１８に示す従来の空燃比センサー９０と本例の空燃比センサー１とを同じ条件で実車に装着し，それぞれ５回ずつ凝縮水の付着の有無をテストしたところ，従来の空燃比センサー９０では，５回中４回について凝縮水の付着が見られたが，本例の空燃比センサー１はでは１度も凝縮水の付着が見られなかった。

【００３４】実施形態例２

本例は，図５に示すように，実施形態例１において，内カバー３１の先端面と外カバー３２の先端面との間に凝縮水の捕捉部材２５を設けたもう１つの実施形態例である。上記捕捉部材２５には，セラミック系の結晶質の繊維，焼結した多孔質体のシート，あるいは金属系の材料からなるメッシュのシート等がある。これにより，凝縮水は捕捉部材２５に付着し酸素検知素子１０まで達しにくくなる。その他については，実施形態例１と同様である。

【００３５】実施形態例３

本例は，図６，図７に示すように，実施形態例１において，外カバー３３の側面開口部２４を軸心線Ｃの周りに縦に２列に配置した空燃比センサー１の例である。その他については，実施形態例１と同様であり，同様の効果を得ることが出来る。

【００３６】実施形態例４

本例は，図８に示すように，実施形態例３において，内カバー３１の先端面と外カバー３３の先端面との間に実施形態例２に示したのと同様の凝縮水の捕捉部材２５を設けたもう１つの実施形態例てある。その他については，実施形態例３と同様である。

【００３７】実施形態例５

本例は，図９～図１１に示すように，実施形態例１において，内カバー３４と外カバー３５の端面開口部２１，２２の配置を実施形態例１と反対にしたもう一つの実施形態例である。即ち，内カバー３４の端面開口部２１は略軸心線Ｃ上に１個だけ形成され，外カバー３５の端面開口部２２は軸心線Ｃの周りに略対称形に３個配置されている。その他については，実施形態例１と同様である。

【００３８】実施形態例６

本例は，図１２に示すように，実施形態例５において，内カバー３４の先端面と外カバー３５の先端面との間に実施形態例２に示したのと同様の凝縮水の捕捉部材２５を設けたもう１つの実施形態例てある。その他については，実施形態例５と同様である。

【００３９】実施形態例７

本例は，図１３，図１４に示すように，実施形態例３において，内カバー３４と外カバー３６の端面開口部２１，２２の配置を実施形態例２と反対にしたもう一つの実施形態例である。即ち，内カバー３４の端面開口部２１は図１０に示したように略軸心線Ｃ上に１個だけ形成され，外カバー３６の端面開口部２２は図１４に示すように軸心線Ｃの周りに略対称形に３個配置されている。その他については，実施形態例２と同様である。

【００４０】実施形態例８

本例は，図１５に示すように，実施形態例７において，内カバー３４の先端面と外カバー３６の先端面との間に実施形態例２に示したのと同様の凝縮水の捕捉部材２５を設けたもう１つの実施形態例てある。その他については，実施形態例７と同様である。

【００４１】なお，上記各実施形態例では，素子カバー３１～３６の先端面は，平面形状としたがこれに限定されるものではなく，曲面であってもよい。また，上記各実施形態例では，開口部の形状は円形のものを示したが，円形に限定する必要はなく，方形その他の形状でもよい。また，上記各実施形態例では，素子カバー３１～３６は，胴部４１にかしめ固定する例を示したが，溶接によって固定する構造とすることもできる。

【００４２】更に，素子の内部に配置されるヒータユニットは，素子内面に接触していなくても良く，例えば，特公平５－４６４９８号公報のような構成であっても良いし，特開平５－２６８４２号公報のような板状の素子でヒーターが積層されるような構成であってもよい。なお，図３，図４に示す形状の内カバー，外カバーとにより二重のカバーを構成する場合において，両カバーの上方（基端側）で互い違いに嵌め合う部分（本例では６個ずつ）に隙間を形成してこれを通気部（開口部）とすることが出来る。

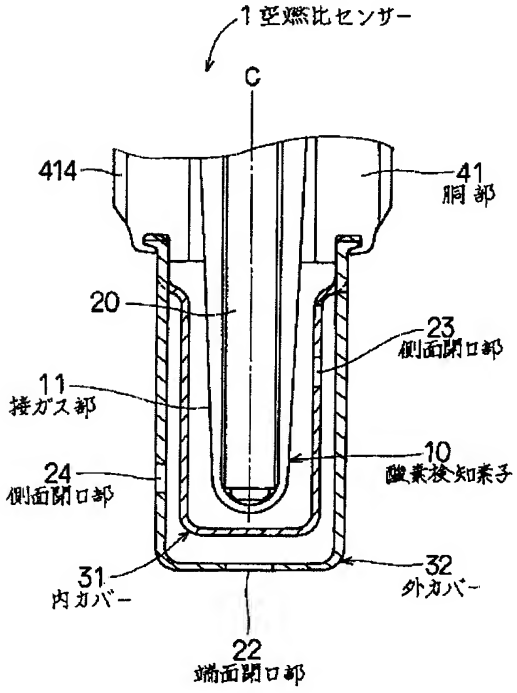
【図面の簡単な説明】

【図１】実施形態例１の空燃比センサーの先端部の部分拡大断面図。

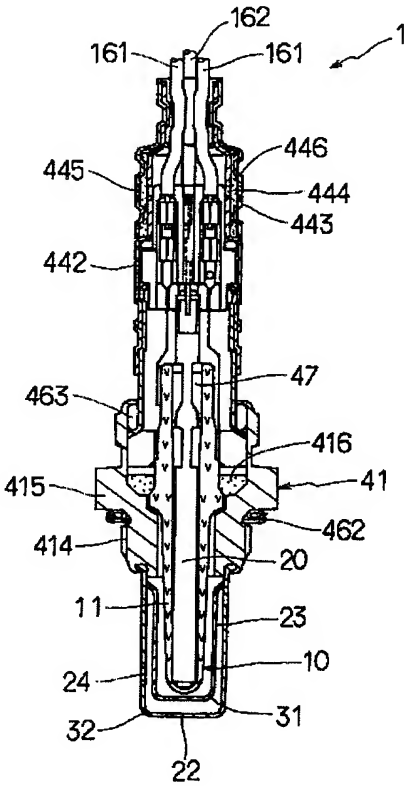
【図２】実施形態例１の空燃比センサーの断面図。

【図３】実施形態例１の空燃比センサーの内カバーの斜視図。
【図４】実施形態例１の空燃比センサーの外カバーの斜視図。
【図５】実施形態例２の空燃比センサーの先端部の部分拡大断面図。
【図６】実施形態例３の空燃比センサーの先端部の部分拡大断面図。
【図７】実施形態例３の空燃比センサーの外カバーの斜視図。
【図８】実施形態例４の空燃比センサーの先端部の部分拡大断面図。
【図９】実施形態例５の空燃比センサーの先端部の部分拡大断面図。
【図１０】実施形態例５の空燃比センサーの内カバーの斜視図。
【図１１】実施形態例５の空燃比センサーの外カバーの斜視図。
【図１２】実施形態例６の空燃比センサーの先端部の部分拡大断面図。
＊【図１３】実施形態例７の空燃比センサーの先端部の部分拡大断面図。
【図１４】実施形態例７の空燃比センサーの外カバーの斜視図。
【図１５】実施形態例８の空燃比センサーの先端部の部分拡大断面図。
【図１６】空燃比センサーの排気管内への配置態様と凝縮水の飛散する様子を模式的に示した図。
【図１７】従来の空燃比センサーの断面図。
【図１８】他の従来の空燃比センサーの先端部の部分拡大断面図。
【符号の説明】
１．．．空燃比センサー，
１０．．．酸素検知素子，
１１．．．接ガス部，
２１，２２．．．端面開口部，
２３，２４．．．側面開口部，
３１，３４．．．内カバー
３２，３３，３５，３６．．．外カバー，
４１．．．胴部，

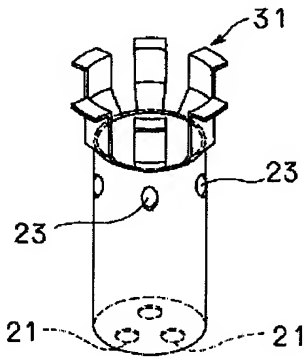
【図１】



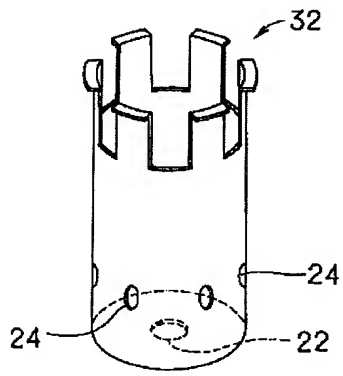
【図２】



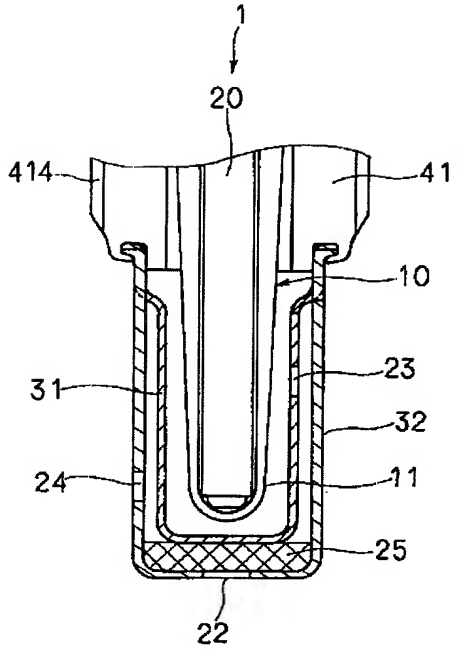
【図３】



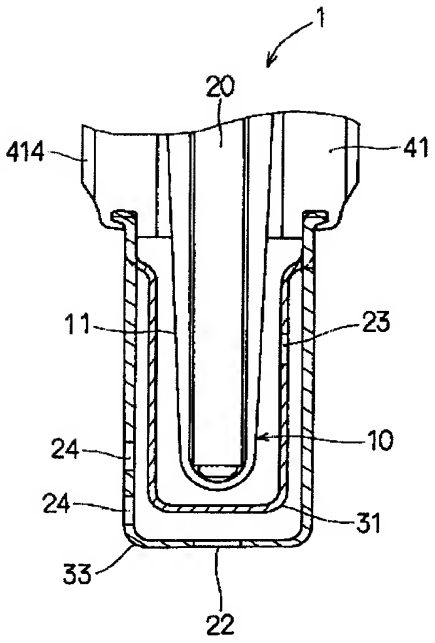
【図４】



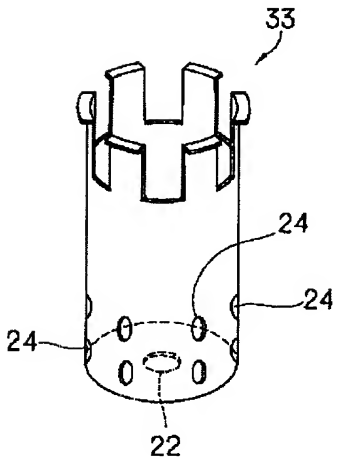
【図５】



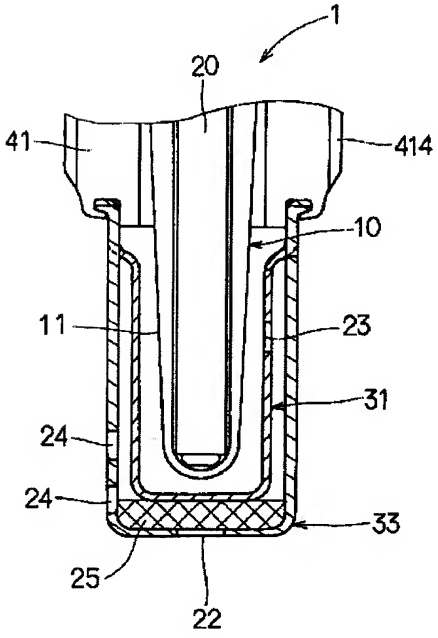
【図６】



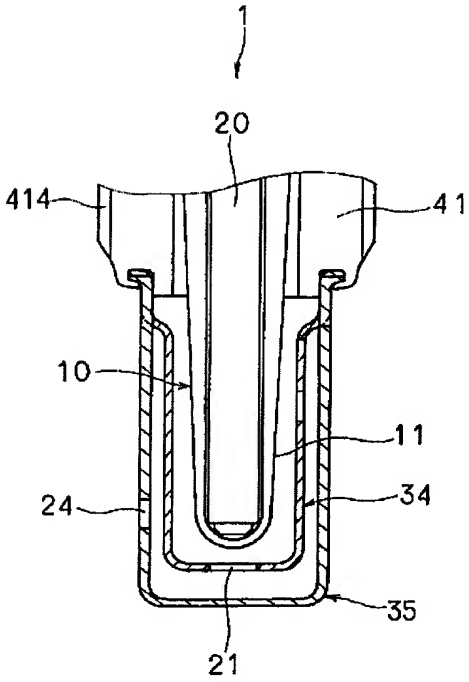
【図７】



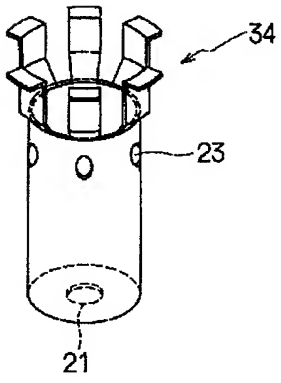
【図８】



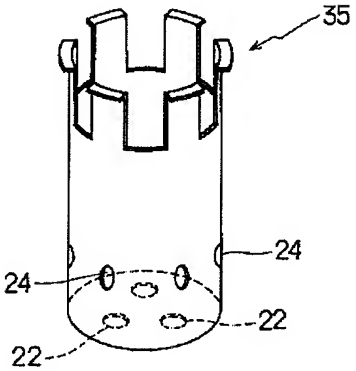
【図９】



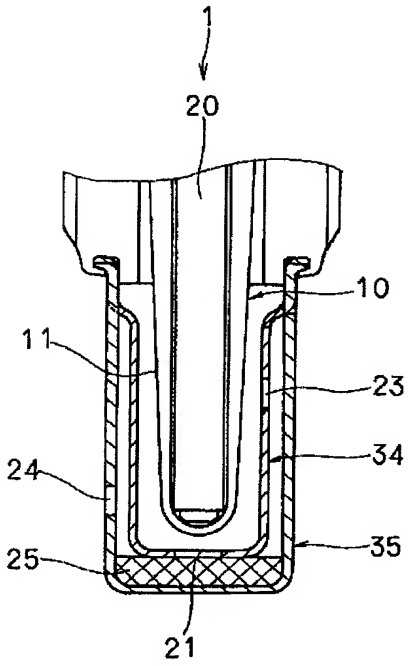
【図１０】



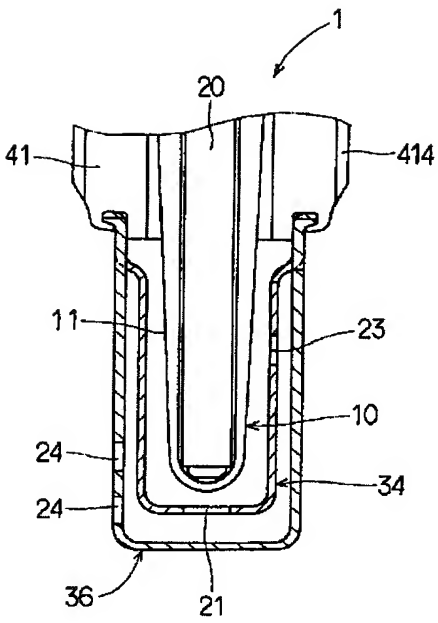
【図１１】



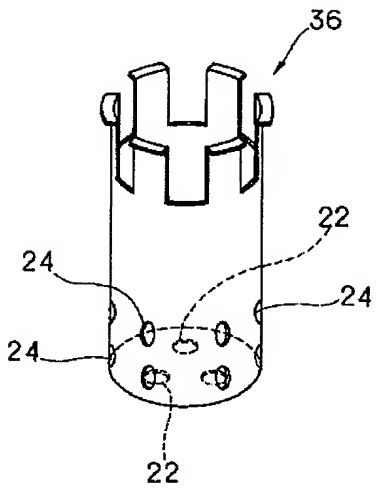
【図１２】



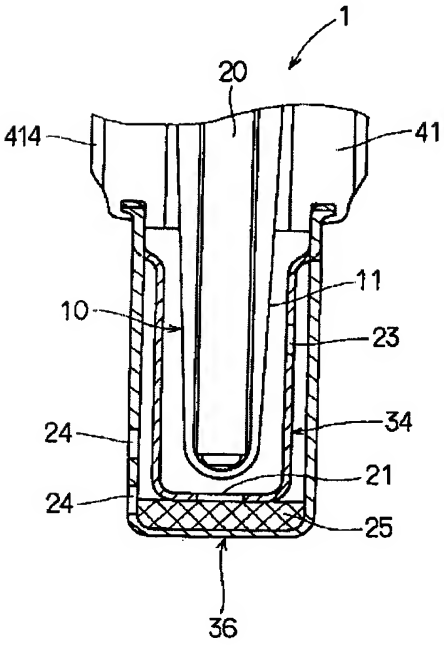
【図１３】



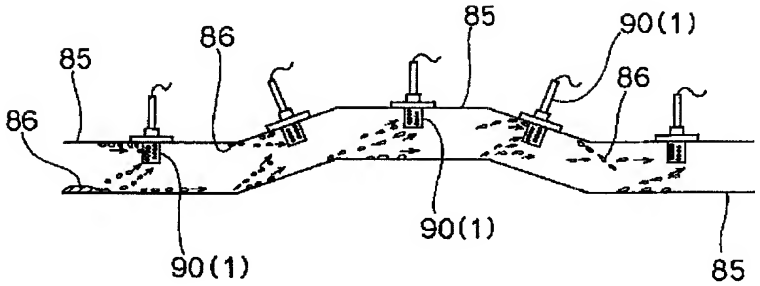
【図１４】



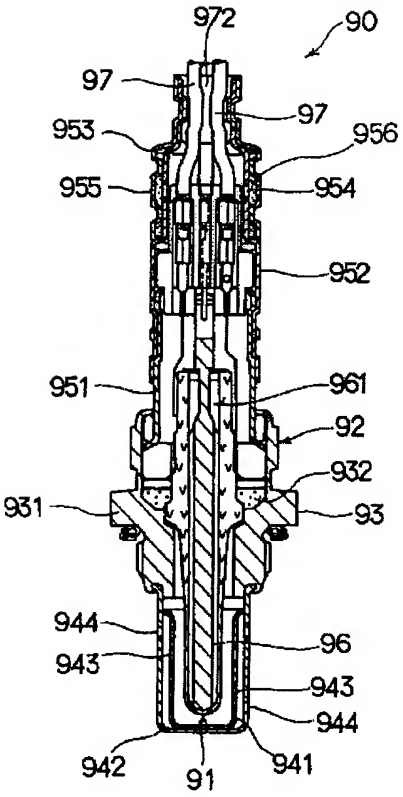
【図１５】



【図１６】



【図１７】



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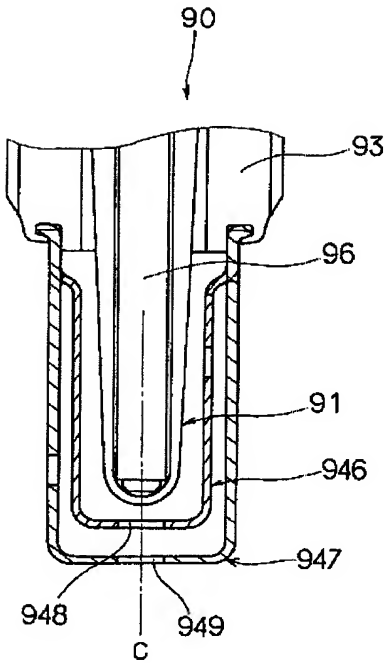

フロントページの続き

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]An oxygen detector element provided with ** Gas Division with gas which consists of solid electrolytes to be measured, Are an element cover provided with a drum section holding this oxygen detector element, and an opening which covers the tip side of ****** Gas Division and introduces exhaust gas an air fuel ratio sensor which it has, and the above-mentioned element cover, An end face opening which it has an inner cover located in the inside near ****** Gas Division and a single or multiple outside cover located in the outside of this inner cover, and introduces exhaust gas into an apical surface of the above-mentioned inner cover and an apical surface of each outside cover is provided, and. An air fuel ratio sensor, wherein each end face opening shifts a position over an end face opening of covering which adjoins so that a channel of exhaust gas which arrives at ****** Gas Division may be lengthened and is arranged.
[Claim 2]In claim 1, a side surface opening part is provided also in the side of said inner cover, and the side of first half each outside cover, and the above-mentioned side surface opening part so that a channel of exhaust gas which arrives at said ** Gas Division may be lengthened. An air fuel ratio sensor which shifting a position over a side surface opening part of adjoining covering, and arranging.
[Claim 3]An air fuel ratio sensor when an exhaust pipe is equipped with a side surface opening part of a surface outside cover located in the outermost part in claim 2, wherein the rate of flow of exhaust gas is provided in a position of tip slippage which becomes large relatively.
[Claim 4]An air fuel ratio sensor, wherein said oxygen detector element is equipped with a heating method for promoting a reaction in claim 2 or claim 3 and a side surface opening part of said inner cover is provided in a position isolated from a hot section of said ** Gas Division.
[Claim 5]In any 1 paragraph of claim 4, from claim 1, an end face opening of said inner cover, An air fuel ratio sensor, wherein it is isolated and arranged from an axial center line which goes to the tip part side from the base end side of said ** Gas Division and an end face opening of an outside cover contiguous to the above-mentioned inner cover is arranged the above-mentioned axial center line top or near the axial center line.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the structure of an air fuel ratio sensor of detecting the air fuel ratio state of exhaust gas, such as an automobile internal-combustion engine, and relates to the sensor structure which can control the fault by penetration of the water of condensation which exists especially in an exhaust pipe.
[0002]
[Description of the Prior Art]Regulation of the air-fuel ratio of an internal-combustion engine is very important because of energy saving (ministry fuel) and emission gas purification. And many electrochemical cells which added the electrode and gas diffusion resistive layer more than a couple are used for the solid electrolyte which has oxygen ion conductivity as a sensor which detects an air-fuel ratio. And at the time of the idling with a low temperature of exhaust gas, and start up, inside the above-mentioned oxygen detector element, it usually counters at the polar zone, and the heater unit is arranged so that the stable output may be obtained.
[0003]That is, as shown, for example in drawing 17, the above-mentioned air fuel ratio sensor 90 has the container 92 which accommodates the oxygen detector element 91 and the oxygen detector element 91 of the shape of a cylinder like object with base which forms an electrochemical cell. The container 92 has the drum section 93 holding the oxygen detector element 91, and the flange 931 for equipping a flueway with a sensor body is formed in the abbreviated center section of the drum section 93. And the portion of the flange 931 to the point turns the tip side caudad, and a flueway is inserted and equipped with it. The oxygen detector element 91 makes the talc 932 interpose, and is being fixed to the drum section 93.
[0004]Inside the oxygen detector element 91, the heater unit 96 is usually inserted, and the heater unit 96 is supported by the oxygen detector element 91 via the holder 961. And the oxygen detector element 91 has a cylinder-like-object-with-base-like solid electrolyte and an electrode for output extraction. And the electrode of the oxygen detector element 91 is connected with the output extraction line 97, and the heater unit 96 is connected to the electric supply line 972.
[0005]On the other hand, it has the element cover 941,942 of the couple of the inside and the outside inserted in a flueway under the drum section 93 (tip side), and has the cover members 951-953 which touch the atmosphere in the upper base end side of the drum section 93. And the opening 943,944 which

introduces exhaust air is formed in the side of each element cover 941,942, and the atmospheric port 954,955 which introduces the atmosphere is established in the cover member 952,953. The water-repellent vent filter 956 is formed in the way which serves as an atmospheric-air-introduction passage by said atmospheric port 954,955 between the cover members 952,953.

[0006]The side surface opening part 943,944 of the above-mentioned element cover 941,942 introduces into the circumference (** Gas Division) of the oxygen detector element 91 promptly the exhaust gas which is gas to be measured, and it must be formed so that the speed of response of a sensor may be sped up. However, on the other hand, the water of condensation (only henceforth the water of condensation) etc. which exist in the foreign matter and flueway in exhaust gas need to control adhering to the oxygen detector element 91.

[0007]That is, as shown in drawing 16, the air fuel ratio sensor 90 turns the tip side down, and is attached to various positions of the exhaust pipe 85. And for the purpose of detecting the oxygen density in the downstream exhaust gas of a catalyst purge, in order not to put the oxygen detector element 91 to hot exhaust gas, The air fuel ratio sensor 90 is coming to be arranged not at the exhaust manifold of the exit of an internal-combustion engine but at the exhaust pipe 85 of the downstream. And the case where the water of condensation 86 stagnates in the bottom arises to the Lord inside the exhaust pipe 85 of the downstream, therefore this disperses with the flow of exhaust gas at the time of engine start up, etc., and it advances into the inside of the air fuel ratio sensor 90 from said opening 943,944.

[0008]And when the above-mentioned water of condensation 86 adheres to the oxygen detector element 91, the fault that an element breaks for the heat stress it not only changes a detecting characteristic, but produced when the low-temperature water of condensation adheres to a hot element may be produced. Therefore, in order to lengthen the circulation way of exhaust air and to keep the water of condensation from reaching an oxygen detector element, the above-mentioned opening 943,944 is alternately arranged so that it may become the labyrinth shape which wound. The sake forms two or more element covers 941,942, and also makes it multiplex.

[0009]In order to make foreign matters, such as the water of condensation which advanced into the inside of an element cover, automatically dropped outside as shown in drawing 18, the structure of forming the opening 948,949 also at the tip of the element cover 946,947 is proposed, and it is (JP,5-26842,A etc.). If the opening 948,949 is formed at the tip of the element cover 946,947, penetration of exhaust gas will be made easier than an opening increases, and there is also an advantage of making the response of a sensor good.

[0010]

[Problem(s) to be Solved]However, in spite of having taken the above preventive measures, the fault that control of the water-of-condensation adhesion to an oxygen detector element is still insufficient, and an element sometimes breaks has arisen. this invention tends to provide the air fuel ratio sensor which can control effectively internal penetration and element cracks of the water of condensation, holding the response characteristic of those with ** which were made in view of this conventional problem, and a sensor good.

[0011]

[Means for Solving the Problem]An invention of claim 1 of this application provides an end face opening

which introduces exhaust gas into an apical surface of an inner cover, and an apical surface of each outside cover, and each end face opening shifts and arranges a position over an end face opening of covering which adjoins so that a channel of exhaust gas which arrives at ** Gas Division may be lengthened. As a result, the air fuel ratio sensor of this invention can control penetration of the water of condensation effectively.

[0012]That is, as shown in drawing 16, the water of condensation 86 adhering to the exhaust pipe 85 exists at the pars basilaris ossis occipitalis of the exhaust pipe 85 especially mostly, and this is pressured upwards up with engine start up. Therefore, many water of condensation 86 will advance toward the upper part from an apical surface of an element cover. So, when [which is shown in drawing 18] an opening is arranged like the tip opening 948,949 of a device before at the same position so that it may overlap mutually. The water of condensation 86 advances toward the oxygen detector element 91 straight from the opening 948,949, and it becomes easy to adhere to a tip part of the oxygen detector element 91.

[0013]However, in this invention, since a position is shifted mutually and an end face opening is arranged so that a channel of exhaust gas which arrives at ** Gas Division may be lengthened, it adheres to an element cover in the middle of a long channel, and it becomes difficult to give it to ** Gas Division of an oxygen detector element.

[0014]In an invention of claim 2, further, a side surface opening part is provided, and a side surface opening part is arranged so that a channel of exhaust gas which arrives at ** Gas Division may be lengthened. Therefore, it becomes difficult to give the water of condensation which advances from a side surface opening part to ** Gas Division. Since a side surface opening part counters a flow of exhaust gas, it can take in exhaust gas promptly and can make a response of a sensor good.

[0015]As for the side surface opening part of a surface outside cover according to claim 3 located in the outermost part like, when an exhaust pipe is equipped, it is preferred that the rate of flow of exhaust gas provides in tip slippage which becomes large relatively. Since distribution of the rate of flow of exhaust gas in an exhaust pipe becomes large as it goes to the central part of a pipeline from a tube wall, the above-mentioned side surface opening part has a large effect that being located in the central part of an exhaust pipe way thru/or its neighborhood takes in exhaust gas. And since it becomes a portion of tip slippage of an element cover, being located the central part thru/or near the exhaust pipe way, when a pipeline is equipped can take in exhaust gas efficiently.

[0016]And as for a side surface opening part of said inner cover, in a case where an oxygen detector element is equipped with heating methods (heater etc.) for promoting a reaction etc., it is [like] preferred to provide in the position according to claim 4 isolated from a hot section of ** Gas Division. As mentioned above, element cracks which the water of condensation adheres to an oxygen detector element, and are produced are based on heat stress by the low-temperature water of condensation adhering to a hot element. Therefore, it is because it is desirable to make it structure which serves as a low temperature part of an element as much as possible as for a place where the water of condensation which advanced into an inside adheres to an element.

[0017]As for an opening of an apical surface of an outside cover which keeps its distance from the axial center line C according to claim 5 which goes an opening of an apical surface of an inner cover to the tip part side from the base end side of ** Gas Division like, forms, and adjoins the above-mentioned inner cover, it is preferred to form the above-mentioned axial center line top or near the axial center line. If an end

face opening of an inner cover is arranged like a device before the axial center line C top (drawing 18) of the oxygen detector element 90, or near the axial center line, it will concentrate on the central part (a near axial center line) at a tip of an element from an end face opening of an inner cover close to an element, and the water of condensation which advanced into an element part will adhere easily.

[0018]And since the water of condensation focuses, heat stress accompanying water-of-condensation adhesion becomes large, and it becomes easy to start element cracks. However, in the invention according to claim 5, since the water of condensation does not focus on the tip central part of an element but distributes by keeping one's distance from the surroundings of an axial center line, and arranging an opening of an apical surface of an inner cover widely as mentioned above, heat stress accompanying adhesion of the water of condensation becomes small, and it becomes difficult to start element cracks.

[0019]

[Embodiment of the Invention]

The oxygen detector element 10 provided with ** Gas Division 11 which consists of solid electrolytes as the example of one example of an embodiment was shown in drawing 1 and drawing 2, It is the air fuel ratio sensor 1 of the internal-combustion engine which has the element covers 31 and 32 provided with the drum section 41 holding this oxygen detector element, and the openings 21-24 which cover the tip side of ** Gas Division 11, and introduce exhaust gas.

[0020]The element covers 31 and 32 have the inner cover 31 located in the inside near ** Gas Division 11, and the outside cover 32 located in the outside of this inner cover 31, as shown in drawing 3 and drawing 4. And the end face openings 21 and 22 which introduce exhaust gas are formed in the apical surface of the inner cover 31, and the apical surface of the outside cover 32, and each end face openings 21 and 22 so that the channel of the exhaust gas which arrives at ** Gas Division 11 may be lengthened. The end face openings 22 and 21 of adjoining covering shift a position mutually, and are arranged.

[0021]The end face opening 21 of the inner cover 31 keeps its distance from the surroundings of the axial center line C (drawing 1) which goes to the tip part side from the base end side of ** Gas Division 11, and is arranged at three approximately symmetric figures, and only the one end face opening 22 of the outside cover 32 contiguous to the inner cover 31 is formed on the above-mentioned axial center line C. The six side surface opening parts 23 and 24 are formed at a time in the side of the inner cover 31, and the side of the outside cover 32, respectively, and the side surface opening parts 23 and 24 so that the channel of the exhaust gas which arrives at ** Gas Division 11 may be lengthened. The side surface opening parts 24 and 23 of adjoining covering are arranged so that a position may be shifted mutually and it may not face each other.

[0022]And the side surface opening part 24 of the outside cover 32 is formed in the tip slippage to which the rate of flow of exhaust gas becomes large relatively, when the exhaust pipe 85 is equipped, as shown in drawing 16. As shown in drawing 1 and drawing 2, the oxygen detector element 10 is equipped with the heating method (heater unit 20) for promoting a reaction, and the side surface opening part 23 of the inner cover 31 is formed in the base end slippage (relatively part where temperature is low) which is separated from the hot section of ** Gas Division 11.

[0023]Hereafter, it supplements with explanation about each. This example is the air fuel ratio sensor 1 which detects the air-fuel ratio of the engine of a car. As shown in drawing 2, the drum section 41 has the

thread part 414 screwed in the screw hole established in the flueway, and the flange 415 which contacts a flueway. The air intake 444,445 which introduces the atmosphere into the oxygen detector element 10 is formed in the cover member 442,443 located in the base end side. The water-repellent vent filter 446 is formed in the way which serves as an atmospheric-air-introduction passage by said air intake 444 and 445.

[0024]The oxygen detector element 10 makes the talc 416 interpose, and is held at the drum section 41. As for the numerals 462, in drawing 2, a metallic ring and the numerals 161 of a gasket and the numerals 463 are output extraction lines. The heater unit 20 is inserted inside the oxygen detector element 10, and the heater unit 20 is supported by the oxygen detector element 10 via the holder 47. And the heating wire which is not illustrated is attached to the heater unit 20, and this heating wire is connected to the electric supply line 162.

[0025]The output extraction line 161 and the electric supply line 162 are being fixed by the cover member 442,443 via the bush. The atmospheric air passage which draws the atmosphere taken in from the air intake 444,445 inside the oxygen detector element 10 and which is not illustrated is provided.

[0026]Next, the operation effect of the air fuel ratio sensor 1 of this example is described. The covering 32 which adjoins so that the air fuel ratio sensor 1 of this example may form the end face openings 21 and 22 which introduce exhaust gas into the apical surface of the inner cover 31, and the apical surface of the outside cover 32 as shown in drawing 3 and drawing 4 and each end face openings 21 and 22 may lengthen the channel of the exhaust gas which arrives at ** Gas Division 11, The end face openings 22 and 21 of 31 shift a position mutually, and are arranged. Therefore, penetration of the water of condensation to the oxygen detector element 10 can be controlled effectively.

[0027]That is, as shown in drawing 16, the water of condensation 86 adhering to the exhaust pipe 85 collects at the pars basilaris ossis occipitalis of an exhaust pipe especially mostly, and this is pressured upwards up by exhaust gas with engine start up. Therefore, many water of condensation 86 will advance toward the upper part from the apical surface of the element covers 31 and 32. However, in this example, since a position is shifted and the end face openings 21 and 22 are arranged so that the channel of the exhaust gas which arrives at ** Gas Division 11 may be lengthened, the water of condensation 86 has penetration barred in the middle of the channel from the end face opening 22 of an outside cover to ** Gas Division 11, and does not attain them easily to ** Gas Division 11.

[0028]The side surface opening parts 23 and 24 are formed in the side of the element covers 31 and 32, and since it is arranged so that the channel of the exhaust gas with which the above-mentioned side surface opening parts 23 and 24 also arrive at ** Gas Division 11 may be lengthened, it becomes difficult to give the water of condensation 86 which advances from the side surface opening parts 23 and 24 to ** Gas Division 11. And since the side surface opening parts 23 and 24 counter the flow of exhaust gas, they can take in exhaust gas promptly and can make the response of a sensor good.

[0029]Since the rate of flow of exhaust gas is provided in the tip slippage which becomes large relatively when the exhaust pipe 85 is equipped, the side surface opening part 24 of the outside cover 32 tends to take in exhaust gas. That is, since distribution of the rate of flow of the exhaust gas in the exhaust pipe 85 becomes large as it goes to the central part of a pipeline from a tube wall, the side surface opening part 24 located in the central part of the exhaust pipe 85 thru/or its neighborhood tends to take in exhaust gas.

[0030]The side surface opening part 23 of the inner cover 31 is formed in the base end slippage isolated

from the hot section (tip slippage) of ** Gas Division 11. As mentioned above, as for the element cracks which the water of condensation adheres to the oxygen detector element 10, and are produced, since it is based on the heat stress in which the low-temperature water of condensation adhered to the hot element, when adhesion for the element of the water of condensation which advanced is not avoided, it is desirable to use structure of adhering to the low temperature part of an element as much as possible. Therefore, heat stress according [the water of condensation] to adhesion of the water of condensation with this device of ** Gas Division 11 which adheres to a low-temperature part comparatively becomes small, and it becomes difficult to produce element cracks.

[0031]As shown in drawing 3, the opening 21 of the apical surface of the inner cover 31. Its distance is kept from the surroundings of the axial center line C (drawing 1) which goes to the tip part side from the base end side of ** Gas Division 11, and it arranges to an approximately symmetric figure, and the opening 22 of the apical surface of the outside cover 32 contiguous to the inner cover 31 is formed on the above-mentioned axial center line C, as shown in drawing 4.

[0032]it is shown in drawing 18, if the end face opening 948 of the inner cover 946 and the end face opening 949 of the outside cover 947 are arranged on the axial center line C like a device before, The water of condensation 86 which advances into an element part adheres to the central part (near axial center line C) at the tip of the oxygen detector element 91 easily intensively from the end face opening 948,949 of the above-mentioned inner cover 946 and the outside cover 947. And since the water of condensation focuses, the heat stress accompanying water-of-condensation adhesion becomes large, and it becomes easy to start element cracks. However, by keeping one's distance and distributing widely the opening 21 of the apical surface of the inner cover 31 over the surroundings of the axial center line C like this example, The heat stress accompanying adhesion of the water of condensation becomes small, and element cracks become difficult to start the end face openings 21 and 22 of the inner cover 31 and the outside cover 32 by having shifted the position mutually from the water of condensation not focusing on the tip central part of an element, but distributing.

[0033]As a result, when the real vehicle was equipped with the conventional air fuel ratio sensor 90 and the air fuel ratio sensor 1 of this example which are shown in drawing 18 on the same conditions and the existence of adhesion of the water of condensation was tested 5 times, respectively, in the conventional air fuel ratio sensor 90, adhesion of the water of condensation was seen about 4 times among 5 times, but. As for the air fuel ratio sensor 1 of this example, adhesion of the water of condensation was not then seen once.

[0034]In the example 1 of an embodiment, the example of two examples of an embodiment is another example of an embodiment which formed the catch member 25 of the water of condensation between the apical surface of the inner cover 31, and the apical surface of the outside cover 32, as shown in drawing 5. There is textiles of the crystalline substance of a ceramic system, a sheet of the sintered porous body, or a sheet of the mesh which consists of material of a metal system in the above-mentioned catch member 25. Thereby, the water of condensation adheres to the catch member 25, and it becomes difficult to attain it to the oxygen detector element 10. About others, it is the same as that of the example 1 of an embodiment.

[0035]In the example 1 of an embodiment, the example of three examples of an embodiment is an example of the air fuel ratio sensor 1 which has arranged the side surface opening part 24 of the outside cover 33

perpendicularly around the axial center line C at two rows, as shown in drawing 6 and drawing 7. About others, it is the same as that of the example 1 of an embodiment, and the same effect can be acquired.

[0036]Another example ****** of an embodiment which formed the catch member 25 of the water of condensation same with having been shown in the example 2 of an embodiment in the example 3 of an embodiment between the apical surface of the inner cover 31, and the apical surface of the outside cover 33 as the example of four examples of an embodiment was shown in drawing 8. About others, it is the same as that of the example 3 of an embodiment.

[0037]In the example 1 of an embodiment, the example of five examples of an embodiment is another example of an embodiment which carried out arrangement of the end face openings 21 and 22 of the inner cover 34 and the outside cover 35 reversely with the example 1 of an embodiment, as shown in drawing 9 - drawing 11. That is, only the one end face opening 21 of the inner cover 34 is formed on the abbreviated axial center line C, and the end face opening 22 of the outside cover 35 is arranged around the axial center line C at three approximately symmetric figures. About others, it is the same as that of the example 1 of an embodiment.

[0038]Another example ****** of an embodiment which formed the catch member 25 of the water of condensation same with having been shown in the example 2 of an embodiment in the example 5 of an embodiment between the apical surface of the inner cover 34, and the apical surface of the outside cover 35 as the example of six examples of an embodiment was shown in drawing 12. About others, it is the same as that of the example 5 of an embodiment.

[0039]In the example 3 of an embodiment, the example of seven examples of an embodiment is another example of an embodiment which carried out arrangement of the end face openings 21 and 22 of the inner cover 34 and the outside cover 36 reversely with the example 2 of an embodiment, as shown in drawing 13 and drawing 14. That is, only the one end face opening 21 of the inner cover 34 is formed on the abbreviated axial center line C, as shown in drawing 10, and the end face opening 22 of the outside cover 36 is arranged around the axial center line C at three approximately symmetric figures, as shown in drawing 14. About others, it is the same as that of the example 2 of an embodiment.

[0040]Another example ****** of an embodiment which formed the catch member 25 of the water of condensation same with having been shown in the example 2 of an embodiment in the example 7 of an embodiment between the apical surface of the inner cover 34, and the apical surface of the outside cover 36 as the example of eight examples of an embodiment was shown in drawing 15. About others, it is the same as that of the example 7 of an embodiment.

[0041]In each above-mentioned example of an embodiment, although the apical surface of the element covers 31-36 considers it as plane shape, it may not be limited to this, and it may be a curved surface. In each above-mentioned example of an embodiment, although the shape of the opening showed the circular thing, it is not necessary to limit it circularly and a rectangle and other shape may be sufficient as it. In each above-mentioned example of an embodiment, although the element covers 31-36 showed the example which carries out caulking immobilization to the drum section 41, they can also be made into the structure fixed by welding.

[0042]The heater unit arranged inside an element does not need to touch an element inner surface, for example, may be composition like JP,5-46498,B, and may be the composition that a heater is laminated with

a tabular element like JP,5-26842,A. When the inner cover of the shape shown in drawing 3 and drawing 4 and an outside cover constitute double covering, a crevice can be formed in the portion (this example every six pieces) inserted in mutually alternately in the upper part (end face side) of both coverings, and this can be made into a ventilation part (opening).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 1 of an embodiment.
[Drawing 2]The sectional view of the air fuel ratio sensor of the example 1 of an embodiment.
[Drawing 3]The perspective view of the inner cover of the air fuel ratio sensor of the example 1 of an embodiment.
[Drawing 4]The perspective view of the outside cover of the air fuel ratio sensor of the example 1 of an embodiment.
[Drawing 5]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 2 of an embodiment.
[Drawing 6]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 3 of an embodiment.
[Drawing 7]The perspective view of the outside cover of the air fuel ratio sensor of the example 3 of an embodiment.
[Drawing 8]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 4 of an embodiment.
[Drawing 9]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 5 of an embodiment.
[Drawing 10]The perspective view of the inner cover of the air fuel ratio sensor of the example 5 of an embodiment.
[Drawing 11]The perspective view of the outside cover of the air fuel ratio sensor of the example 5 of an embodiment.
[Drawing 12]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 6 of an embodiment.
[Drawing 13]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 7 of an embodiment.
[Drawing 14]The perspective view of the outside cover of the air fuel ratio sensor of the example 7 of an embodiment.
[Drawing 15]The partial expanded sectional view of the tip part of the air fuel ratio sensor of the example 8 of

an embodiment.

[Drawing 16]The figure showing typically signs that the arranging mode into the exhaust pipe of an air fuel ratio sensor and the water of condensation disperse.

[Drawing 17]The sectional view of the conventional air fuel ratio sensor.

[Drawing 18]The partial expanded sectional view of the tip part of other conventional air fuel ratio sensors.

[Description of Notations]

1 ... Air fuel ratio sensor

10 ... Oxygen detector element,

11 ... ** Gas Division,

21, 22 ... End face opening,

23, 24 ... Side surface opening part,

31, 34 ... Inner cover

32, 33, 35, 36 ... Outside cover

41 ... Drum section,

[Translation done.]

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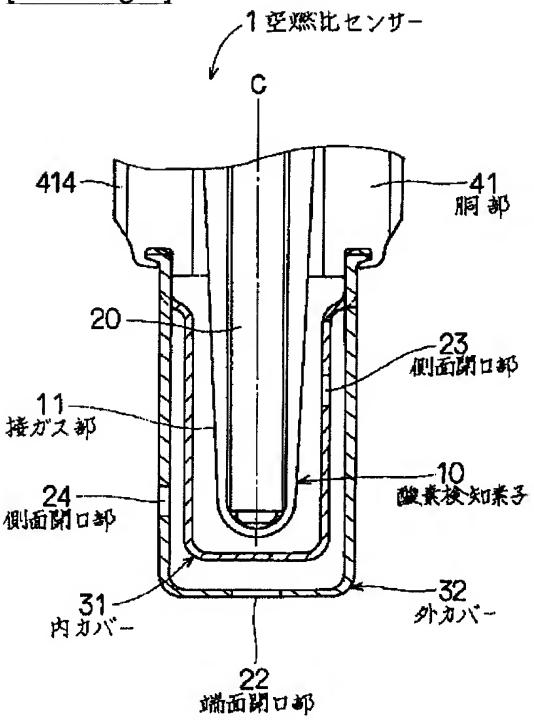
DRAWINGS

[Drawing 1]



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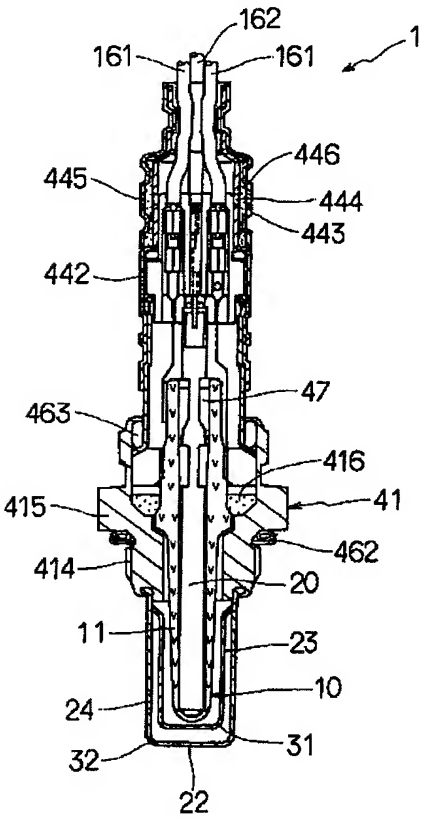

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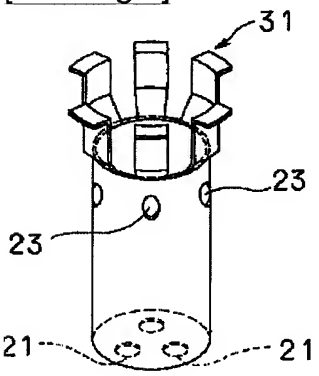

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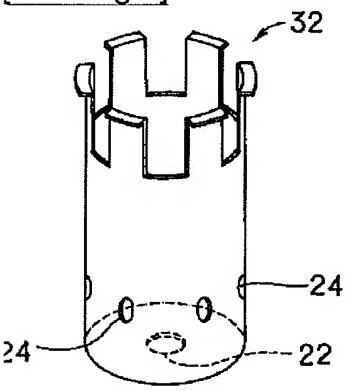
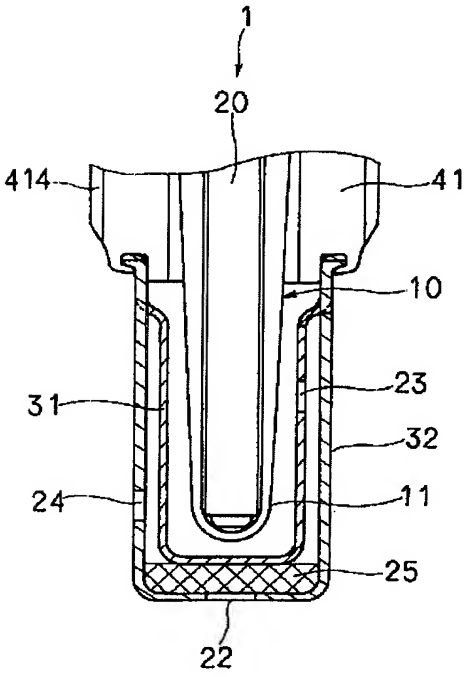
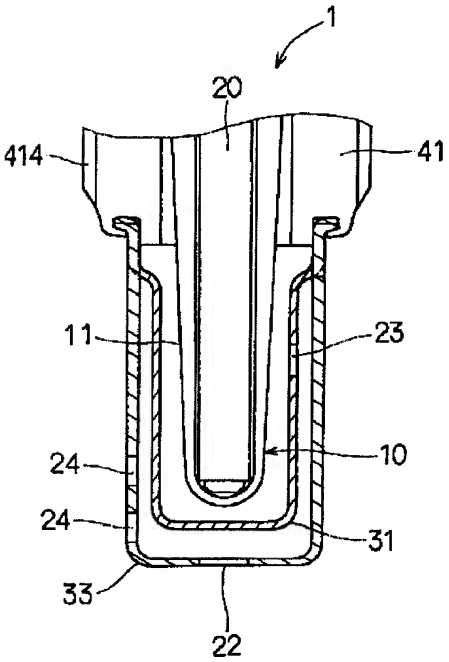


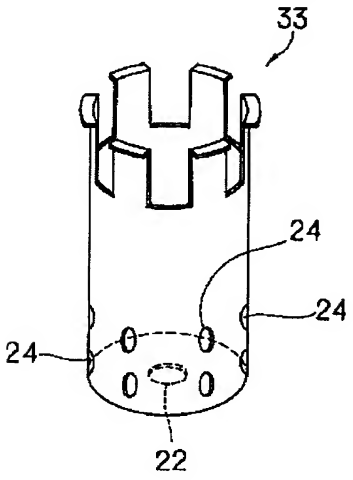
[Drawing 5]



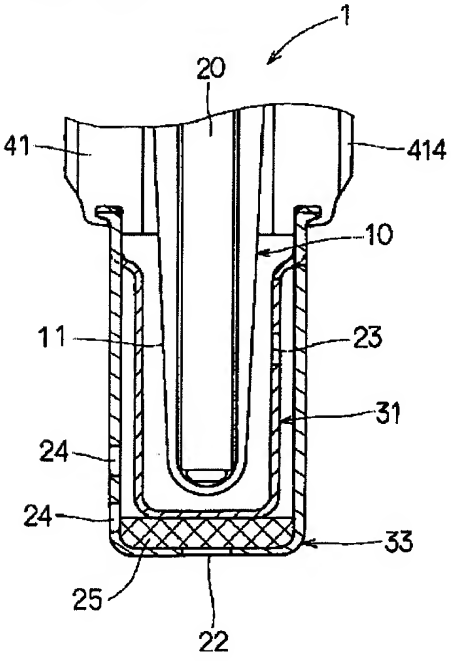
[Drawing 6]



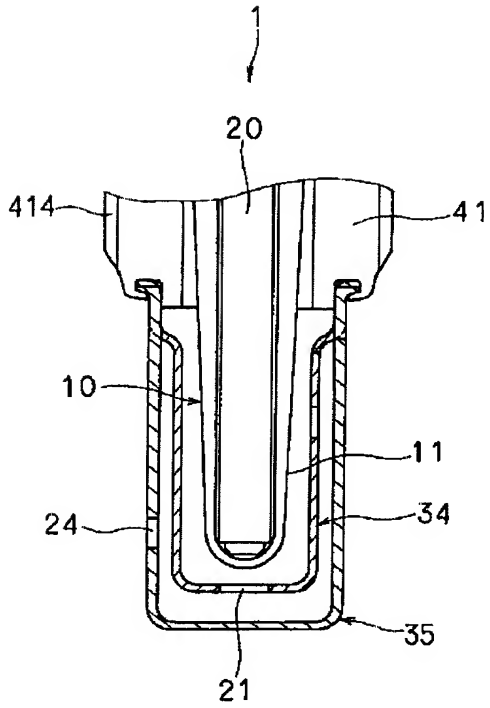
[Drawing 7]



[Drawing 8]



[Drawing 9]



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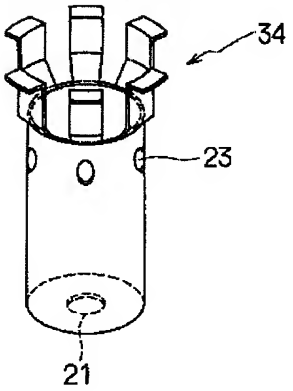

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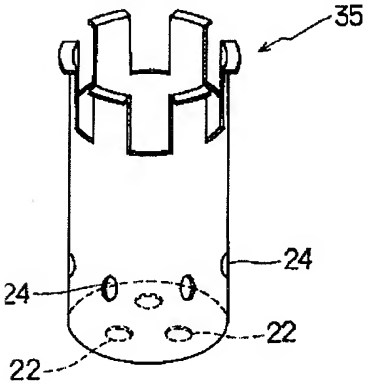

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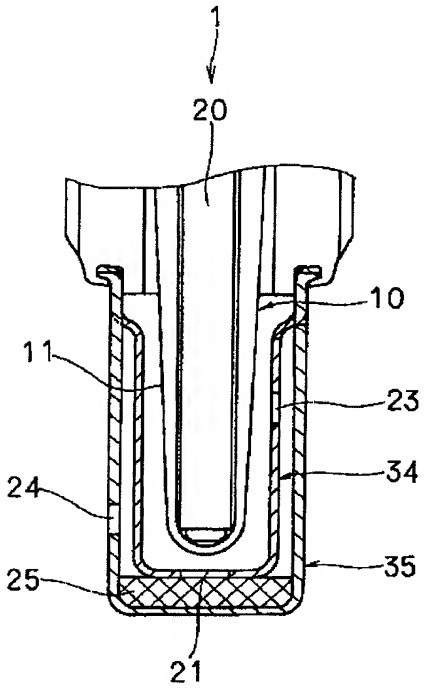
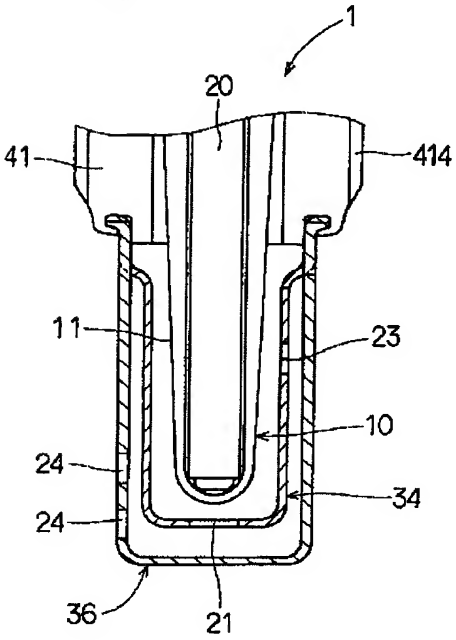
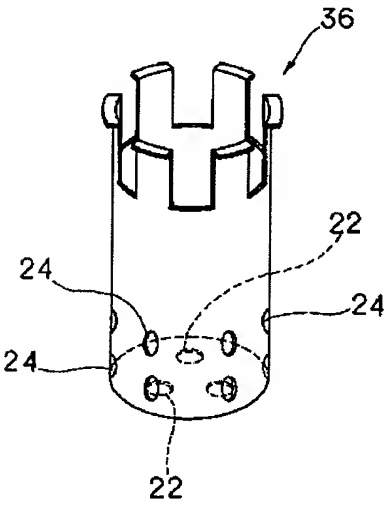


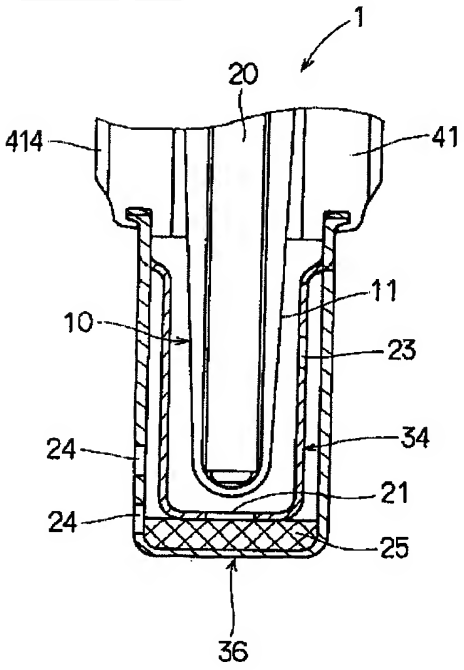
[Drawing 13]



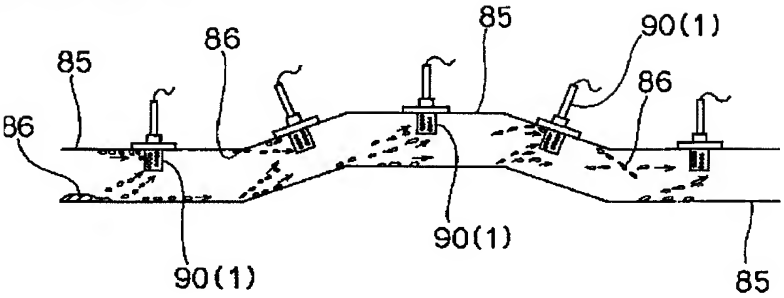
[Drawing 14]



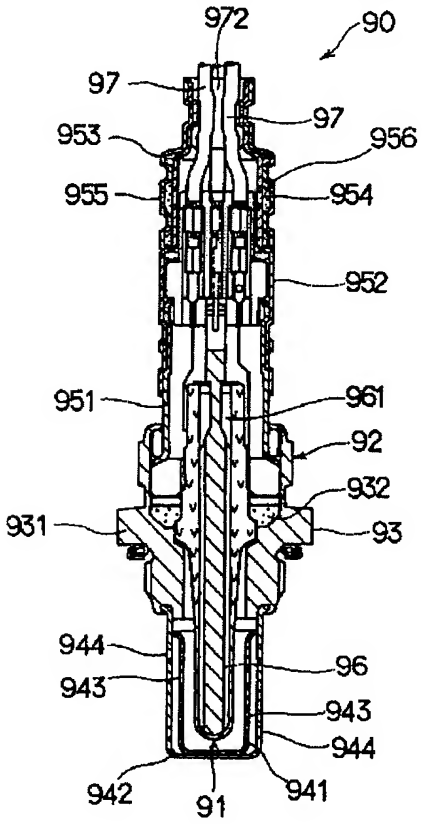
[Drawing 15]



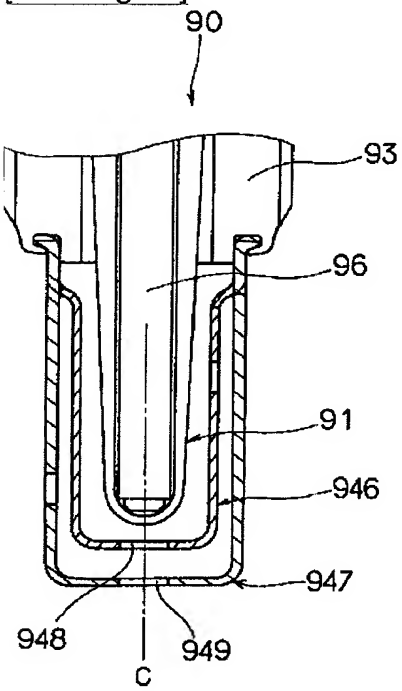
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]